CLAIMS:

1. Spectral interferometry apparatus, comprising an interferometer adapted to be excited by an optical source, the said interferometer comprising:

object optics arranged to transfer a beam from the optical source to a target object to produce an object beam;

reference optics arranged to produce a reference beam;

displacing means arranged to displace at least one of the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam;

wherein there is an optical path difference between the relatively displaced object beam and the relatively displaced reference beam generated in the interferometer; and

optical spectrum dispersing means arranged to receive the two relatively displaced beams, and to disperse their spectral content onto a reading element;

wherein in use the combination of the displacing means and the optical spectrum dispersing means is arranged to create an intrinsic optical delay between the wavetrains of the two relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element; and

wherein the displacing means is adapted to relatively displace the object beam and the reference beam to produce the relatively displaced object beam and the relatively displaced reference beam using one or a combination of reflection, deflection, or refraction of at least one of the object beam and the reference beam.

2. Spectral interferometry apparatus according to Claim 1, wherein the displacing means comprises at least two reflective elements, one of said at least two reflective elements being arranged to reflect the object beam and another of said at least two reflective elements being arranged to reflect the reference beam.

3. Spectral interferometry apparatus according to Claim 1, wherein the displacing

means comprises at least one optic-optic modulator.

4. Spectral interferometry apparatus, comprising an interferometer adapted to be excited by an optical source, the said interferometer comprising:

object optics arranged to transfer a beam from the optical source to a target object to produce an object beam;

reference optics arranged to produce a reference beam;

displacing means arranged to displace at least one of the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam;

wherein there is an optical path difference between the relatively displaced object beam and the relatively displaced reference beam generated in the interferometer; and

optical spectrum dispersing means arranged to receive the two relatively displaced beams, and to disperse their spectral content onto a reading element;

wherein in use the combination of the displacing means and the optical spectrum dispersing means is arranged to create an intrinsic optical delay between the wavetrains of the two relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element; and

wherein the object optics includes object fibre optics comprising an object fibre end arranged to transmit the object beam and the reference optics includes reference fibre optics comprising a reference fibre end arranged to transmit the reference beam and the displacing means is arranged to move the relative positions of the object fibre end and the reference fibre end in order to produce the relatively displaced object beam and the relatively displaced reference beam.

5. Spectral interferometry apparatus according to Claim 4, wherein the displacing means is further arranged to produce the relatively displaced object beam and the relatively displaced reference beam by a combination of moving the relative positions of

the object fibre end and the reference fibre end and any one or combination of reflection, deflection, and refraction.

6. Spectral interferometry apparatus, comprising an interferometer adapted to be excited by an optical source, the said interferometer comprising:

object optics arranged to transfer a beam from the optical source to a target object to produce an object beam;

reference optics arranged to produce a reference beam;

displacing means arranged to displace at least one of the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam;

wherein there is an optical path difference between the relatively displaced object beam and the relatively displaced reference beam generated in the interferometer; and

optical spectrum dispersing means arranged to receive the two relatively displaced beams, and to disperse their spectral content onto a reading element;

wherein in use the combination of the displacing means and the optical spectrum dispersing means is arranged to create an intrinsic optical delay between the wavetrains of the two relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element; and

wherein one of the object optics or the reference optics includes fibre optics comprising a fibre end arranged to transmit a respective one of the object beam or the reference beam, and the displacing means is arranged to produce the relatively displaced object beam and the relatively displaced reference beam by movement of the fibre end.

7. Spectral interferometry apparatus according to Claim 6, wherein the displacing means is further arranged to produce the relatively displaced object beam and the relatively displaced reference beam by a combination of moving the fibre end and any one or combination of reflection, deflection, and refraction.

8. Spectral interferometry apparatus according to any one of the preceding claims, wherein the displacing means is adapted to alter the diameters of at least one of the object beam and the reference beam.

9. Spectral interferometry apparatus according to any preceding claim, further comprising means arranged to control the optical path difference in the interferometer.

10. Spectral interferometry apparatus according to any preceding claim, further comprising means arranged to control the intrinsic optical delay between the relatively displaced object beam and the relatively displaced reference beam.

11. Spectral interferometry apparatus according to Claim 10, wherein the means arranged to control the optical path difference and the intrinsic optical delay comprises processing means.

12. Spectral interferometry apparatus according to any preceding claim, wherein the reading element is arranged to provide a signal to a signal analyser, the signal analyser being arranged to determine the distribution of reflections or scattering points in a depth range within the target object.

13. Spectral interferometry apparatus according to Claim 12, wherein the apparatus is arranged to adjust the depth range by adjusting the diameter of at least one of the relatively displaced object beam and the relatively displaced reference beam.

14. Spectral interferometry apparatus according to any preceding claim, further comprising means to match the polarization of the relatively displaced object and the relatively displaced reference beam with that of the optical dispersing means.

15. Spectral interferometry apparatus according to any preceding claim, further comprising means to compensate for dispersion in the interferometer.

16. Spectral interferometry apparatus according to any preceding claim, wherein the displacing means is adapted to relatively orient the relatively displaced object beam and the relatively displaced reference beam in a displacement plane.

17. Spectral interferometry apparatus according to Claim 16, wherein the displacing means is adapted to permit adjustment of the relatively displaced object beam and the relatively displaced reference beam until they become parallel in the displacement plane.

18. Spectral interferometry apparatus according to Claim 16 or 17, wherein the displacement means is arranged to permit an adjustable lateral superposition of the two relatively displaced beams in the displacement plane onto the optical spectrum dispersing means in order to enhance the strength of the signal for small optical path difference values, wherein the lateral superposition is from partial superposition to a total overlap.

19. Spectral interferometry apparatus according to any preceding claim, wherein the displacing means is adapted to relatively orient the relatively displaced object beam and the relatively displaced reference beam such that they hit different portions of the optical spectrum dispersing means.

20. Spectral interferometry apparatus according to any one of the preceding claims, wherein the optical spectrum dispersing means comprises any one of or combination of: a diffraction grating; a prism; a group of prisms; a group of diffraction gratings.

21. Spectral interferometry apparatus according to Claim 20, wherein the optical spectrum dispersing means comprises a diffraction grating, wherein grating lines of the diffraction grating are perpendicular to a line connecting the centre of the relatively displaced reference beam and the centre of the relatively displaced object beam.

22. Spectral interferometry apparatus according to Claim 21, wherein the optical spectrum dispersing means comprises a prism including an entrance surface, wherein a

line connecting the centre of the relatively displaced reference beam and the centre of the displaced object beam, is within the plane defined by the normal to the entrance surface of this prism and its bisectrix.

23. Spectral interferometry apparatus according to any one of the preceding claims, wherein the reference optics comprises at least one reflector arranged to provide a reference light source by reflecting a beam of the optical source, wherein the position or tilt of the reflector can be adjusted in order to control the optical path difference of the relatively displaced object beam and the relatively displaced reference beam.

24. Spectral interferometry apparatus according to any one of the preceding claims, wherein the reference optics is arranged to transfer an optical beam from the optical source to the displacing means along via fibre optics or via reflectors arranged to prevent light form being sent back to the optical source.

25. Spectral interferometry apparatus according to any one of the preceding claims, wherein the object optics comprises a first zoom element arranged to alter the diameter of the object beam.

26. Spectral interferometry apparatus according to any one of the preceding claims, further comprising a third zoom element arranged to alter the diameter of the relatively displaced object beam.

27. Spectral interferometry apparatus according to any one of the preceding claims, wherein the reference optics comprises a second zoom element arranged to alter the diameter of the reference beam.

28. Spectral interferometry apparatus according to any one of the preceding claims, further comprising a fourth zoom element arranged to alter the diameter of the relatively displaced reference beam.

29. Spectral interferometry apparatus according to any one of the preceding claims, wherein the displacement means is arranged to create an adjustable gap between the two relatively displaced beams in order to adjust the minimum optical path difference value for which a modulation of the optical spectrum could be sensed at the reading element.

30. Spectral interferometry apparatus according to Claim 29, wherein interference between the two relatively displaced beams in the interferometer takes place entirely on the said reading element.

31. Spectral interferometry apparatus according to any preceding claim, wherein interference between the two relatively displaced beams is arranged to take place partially on the said reading element and partially on the said optical spectrum dispersing means.

32. Spectral interferometry apparatus according to Claim 31, wherein the displacing means is arranged to adjust the amount of lateral superposition of the said displaced beams in order to enhance the strength of the signal for small optical path difference values.

33. Spectral interferometry apparatus according to Claim 29 or 30 when dependent on Claim 11, wherein the processing means is arranged to control the displacing means in order to adjust the gap between the relatively displaced object beam and the relatively displaced reference beam in order to alter the minimum optical path difference value for which a modulation of the optical spectrum could be sensed at the reading element.

34. Spectral interferometry apparatus according to any one of the preceding claims, wherein the object optics further comprises a scanning element, the scanning element being arranged to scan the target object.

35. Spectral interferometry apparatus according Claim 34, wherein the scanning element is arranged to perform any one of combination of: linear scanning; raster scanning; elicoidal scanning; circular scanning; or any other random shaped scanning.

36. Spectral interferometry apparatus according to any one of the preceding claims, further comprising focusing elements in the object optics to enhance the signal strength from a particular depth within the object.

37. Spectral interferometry apparatus according to any one of the preceding claims, wherein the interferometer comprises an in-fibre or a bulk interferometer or a hybrid interferometer of in-fibre and bulk components.

38, Spectral interferometry apparatus according to any one of the preceding claims, where the said optical source is a low coherence source.

39. Spectral interferometry apparatus according to any one of the preceding claims, wherein the said reading element comprises: a photodetector array; a CCD linear array; a two dimensional array of photodetectors; a two dimensional CCD array; or a point photodetector over which the dispersed spectrum is scanned.

40. Spectral interferometry apparatus according to any preceding claim, further comprising:

beam splitting means arranged to receive the object beam and the reference beam and to produce a second object beam and a second reference beam;

second displacing means arranged to displace at least one of the second object beam and the second reference beam to produce a second relatively displaced object beam and a second relatively displaced reference beam,

second optical spectrum dispersing means arranged to receive the second relatively displaced object beam and the second relatively displaced reference beam, and to disperse their spectral content onto a second reading element;

wherein in use the combination of the second displacing means and the second optical spectrum dispersing means is arranged to create a second intrinsic optical delay

between the wavetrains of the second relatively displaced object beam and the second relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the second reading element.

41. Spectral interferometry apparatus according to Claim 42, wherein the second displacing means is adapted to produce the second relatively displaced object beam and the second relatively displaced reference beam by using one or a combination of reflection, deflection and refraction of at least one of the second object beam and the second reference beam.

42. Spectral interferometry apparatus according to any one of claims 40 and 41, wherein the optical spectrum dispersing means and the second optical dispersing means are oriented in such way that in combination with their respective relatively displaced object beam and relatively displaced reference beam, the spectrally dispersed beams from the optical spectrum dispersing means and the second optical dispersing means exhibit intrinsic delays of opposite sign.

43. Spectral interferometry apparatus according to Claim 42 when dependent on Claim 12 or any claim dependent on Claim 12, wherein the second reading element is arranged to provide a signal to a second signal analyser, the apparatus being arranged to provide a profile of reflectivity versus optical path difference for the target object covering both signs of optical path difference values on the basis of signals output from the signal analyser and the second signal analyser.

44. Spectral interferometry apparatus according to claim 42, wherein the second optical dispersing means comprises a diffraction grating or gratings, the diffraction grating or gratings being arranged to diffract orders of opposite sign to the said reading element and the said second reading element.

45. Spectral interferometry apparatus according to claim 42, wherein the optical dispersing means and the second optical dispersing means each comprises one or more

prisms, the one or more prisms being arranged such that the relatively displaced object beam or the relatively displaced reference beam is closest to prism apex in the optical dispersing means and the second relatively displaced reference beam or the second relatively displaced object beam respectively is closest to the prism apex in the second optical dispersing means.

46. Spectral interferometry apparatus according to any one of claims 40 to 45, wherein a signal output of each of the reading element and the second reading element is sent to a separate frequency to amplitude converter, the apparatus being arranged such that the output of one frequency to amplitude converter is summed to an inverted output of the other frequency to amplitude converter in order to provide a signal strength proportional to the axial position of a single layer object irrespective of the OPD sign.

47 Spectral interferometry apparatus according to any preceding claim, further comprising:

third beam splitting means arranged between the displacing means and the optical spectrum dispersing means, the beam splitting means being arranged to receive the relatively displaced object beam and the relatively displaced reference beam to produce a third relatively displaced object beam and a third relatively displaced reference beam;

third displacing means arranged to adjust the relative displacement of at least one of the third relatively displaced object beam and the third relatively displaced reference beam;

third optical spectrum dispersing means arranged to receive the third relatively displaced object beam and the third relatively displaced reference beam, and to disperse their spectral content onto a second reading element;

wherein in use the combination of the third displacing means and the third optical spectrum dispersing means is arranged to create a third intrinsic optical delay between the wavetrains of the third relatively displaced object beam and the third relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the third reading element.

48. Spectral interferometry apparatus according to Claim 42, wherein the third displacing means is adapted to adjust the relative displacement of at least one of the third relatively displaced object beam and the third relatively displaced reference beam using one or a combination of reflection, deflection and refraction of at least one of the third relatively displaced object beam and the third relatively displaced reference beam.

49. Spectral interferometry apparatus according to any preceding claim, wherein the source is a low coherence source the output of which is send with a delayed replica by means of an optical duplicating element.

50. Spectral interferometry apparatus according to Claim 49, wherein the optical duplicating element comprises a first single mode coupler whose outputs are connected to two inputs of a second single mode coupler in order to create the delayed replica of the optical source.

51. Spectral interferometry apparatus according to Claim 49, when dependent on Claim 16, wherein the optical duplicating element comprises a transparent optical material in the form of a plate with parallel surfaces, which is introduced halfway through into the beam of the optical source in such a way that its edge is parallel to the said displacement plane.

52. Spectral interferometry apparatus according to any preceding claim, wherein the source is a low coherence source comprising a laser driven below threshold.

53. A spectral interferometry method, comprising:

using an interferometer to output an object beam and a reference beam;

reflecting, deflecting or refracting at least one of said object beam and said reference beam in order to relatively displace at least one of the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam, wherein there is an optical path difference between the relatively

displaced object beam and the relatively displaced reference beam generated in the interferometer;

dispersing the two relatively displaced beams according to their optical spectral content onto a reading element using an optical spectrum dispersing means;

wherein the combination of reflecting, refracting or refracting said object beam and said reference beam to produce a relatively displaced object beam and a relatively displaced reference beam and dispersing the two relatively displaced beams using a optical spectrum dispersing means leads to an intrinsic optical delay between the wavetrains in the two relatively displaced beams which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer.

54. A spectral interferometry method, comprising an interferometer adapted to be excited by an optical source, the said interferometer comprising object optics and reference optics, the method comprising:

using the object optics to transfer a beam from the optical source to a target object to produce an object beam;

using reference optics to produce a reference beam;

using displacing means to displace at least one of the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam;

wherein there is an optical path difference between the relatively displaced object beam and the relatively displaced reference beam generated in the interferometer; and

using optical spectrum dispersing means to receive the two relatively displaced beams, and to disperse their spectral content onto a reading element;

wherein the combination of the displacing means and the optical spectrum dispersing means is arranged to create an intrinsic optical delay between the wavetrains of the two relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element; and

wherein the displacing means relatively displaces the object beam and the reference beam to produce the relatively displaced object beam and the relatively displaced reference beam using one or a combination of reflection, deflection, or refraction of at least one of the object beam and the reference beam.

55. A spectral interferometry method, comprising using an interferometer adapted to be excited by an optical source, the said interferometer including object optics and reference optics, the method comprising:

using the object to transfer a beam from the optical source to a target object to produce an object beam;

using reference optics to produce a reference beam;

using displacing means to displace at least one of the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam;

wherein there is an optical path difference between the relatively displaced object beam and the relatively displaced reference beam generated in the interferometer; and

optical spectrum dispersing means arranged to receive the two relatively displaced beams, and to disperse their spectral content onto a reading element;

wherein the combination of the displacing means and the optical spectrum dispersing means is arranged to create an intrinsic optical delay between the wavetrains of the two relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element; and

wherein the object optics includes object fibre optics comprising an object fibre end arranged to transmit the object beam and the reference optics includes reference fibre optics comprising a reference fibre end arranged to transmit the reference beam and the displacing means moves the relative positions of the object fibre end and the reference fibre end in order to produce the relatively displaced object beam and the relatively displaced reference beam.

56. A spectral interferometry method according to Claim 55, further comprising using the displacing means to produce the relatively displaced object beam and the relatively displaced reference beam by a combination of moving the relative positions of the object fibre end and the reference fibre end and any one or combination of reflection, deflection, and refraction.

57. A spectral interferometry method, comprising using an interferometer adapted to be excited by an optical source, the said interferometer including object optics and reference optics, the method comprising:

using object optics to transfer a beam from the optical source to a target object to produce an object beam;

using reference optics to produce a reference beam;

using displacing means to displace at least one of the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam;

wherein there is an optical path difference between the relatively displaced object beam and the relatively displaced reference beam generated in the interferometer; and

using optical spectrum dispersing means to receive the two relatively displaced beams, and to disperse their spectral content onto a reading element;

wherein in use the combination of the displacing means and the optical spectrum dispersing means is arranged to create an intrinsic optical delay between the wavetrains of the two relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element; and

wherein one of the object optics or the reference optics includes fibre optics comprising a fibre end arranged to transmit a respective one of the object beam or the reference beam, and the displacing means produces the relatively displaced object beam and the relatively displaced reference beam by movement of the fibre end.

58. A spectral interferometry method according to Claim 56, further comprising using the displacing means to produce the relatively displaced object beam and the relatively displaced reference beam by a combination of moving the fibre end and any one or combination of reflection, deflection, and refraction.

59. A spectral interferometry method according to any one of Claims 54 to 58, further comprising using the displacing means to alter the diameters of at least one of the object beam and the reference beam.

60. A spectral interferometry method according to any one of Claims 54 to 59, further comprising controlling the optical path difference in the interferometer.

61. A spectral interferometry method according to any one of Claims 54 to 60, further comprising controlling the intrinsic optical delay between the relatively displaced object beam and the relatively displaced reference beam.

62. A spectral interferometry method according to Claim 61, further comprising using processing means to control the optical path difference and the intrinsic optical delay comprises processing means.

63. A spectral interferometry method according to any one of Claims 54 to 62, further comprising using the reading element to provide a signal to a signal analyser, and using the signal analyser to determine the distribution of reflections or scattering points in a depth range within the target object.

64. A spectral interferometry method according to Claim 63, further comprising adjusting the depth range by adjusting the diameter of at least one of the relatively displaced object beam and the relatively displaced reference beam.

65. A spectral interferometry method according to any one of Claims 54 to 64, further comprising using means to match the polarization of the relatively displaced

object and the relatively displaced reference beam with that of the optical dispersing means.

66. A spectral interferometry method according to any one of Claims 54 to 65, further comprising using means to compensate for dispersion in the interferometer.

67. A spectral interferometry method according to any one of Claims 54 to 66, further comprising using the displacing means to relatively orient the relatively displaced object beam and the relatively displaced reference beam in a displacement plane.

68. A spectral interferometry method according to Claim 67, wherein the displacing means adjusts the relatively displaced object beam and the relatively displaced reference beam until they become parallel in the displacement plane.

69. A spectral interferometry method according to Claim 66 or 67, wherein the displacement means adjusts the lateral superposition of the two relatively displaced beams in the displacement plane onto the optical spectrum dispersing means in order to enhance the strength of the signal for small optical path difference values, wherein the lateral superposition is from partial superposition to a total overlap.

70. A spectral interferometry method according to any one of Claims 54 to 69, wherein the displacing means relatively orients the relatively displaced object beam and the relatively displaced reference beam such that they hit different portions of the optical spectrum dispersing means.

71. A spectral interferometry method according to any one of Claims 54 to 70, wherein the optical spectrum dispersing means comprises a diffraction grating, wherein grating lines of the diffraction grating are perpendicular to a line connecting the centre of the relatively displaced reference beam and the centre of the relatively displaced object beam.

72. A spectral interferometry method according to any one of Claims 54 to 71, wherein the optical spectrum dispersing means comprises a prism including an entrance surface, wherein a line connecting the centre of the relatively displaced reference beam and the centre of the displaced object beam, is within the plane defined by the normal to the entrance surface of this prism and its bisectrix.

73. A spectral interferometry method according to any one of Claims 54 to 72, wherein the reference optics comprises at least one reflector arranged to provide a reference light source by reflecting a beam of the optical source, the method further comprising adjusting the position or tilt of the reflector in order to control the optical path difference of the relatively displaced object beam and the relatively displaced reference beam.

74. A spectral interferometry method according to any one of Claims 54 to 73, further comprising using a first zoom element in the object optics to alter the diameter of the object beam.

75. A spectral interferometry method according to any one of Claims 54 to 74, further comprising using a third zoom element to alter the diameter of the relatively displaced object beam.

76. A spectral interferometry method according to any one of Claims 54 to 74, further comprising using a second zoom element in the reference optics to alter the diameter of the reference beam.

77. A spectral interferometry method according to any one of Claims 53 to 76, further comprising using a fourth zoom element arranged to alter the diameter of the relatively displaced reference beam.

78. A spectral interferometry method according to any one of Claims 53 to 77, wherein the displacement means creates an adjustable gap between the two relatively

displaced beams in order to adjust the minimum optical path difference value for which a modulation of the optical spectrum could be sensed at the reading element.

79. A spectral interferometry method according to Claim 78, wherein interference between the two relatively displaced beams in the interferometer takes place entirely on the said reading element.

80. A spectral interferometry method according to any one of Claims 53 to 79, wherein interference between the two relatively displaced beams is arranged to take place partially on the said reading element and partially on the said optical spectrum dispersing means.

81. A spectral interferometry method according to any one of Claims 53 to 80, further comprising using focusing elements in the object optics to enhance the signal strength from a particular depth within the object.

82. A spectral interferometry method according to any one of Claims 53 to 81, further comprising:

using beam splitting means to receive the object beam and the reference beam and to produce a second object beam and a second reference beam;

using second displacing means arranged to displace at least one of the second object beam and the second reference beam to produce a second relatively displaced object beam and a second relatively displaced reference beam,

using second optical spectrum dispersing means arranged to receive the second relatively displaced object beam and the second relatively displaced reference beam, and to disperse their spectral content onto a second reading element;

wherein in use the combination of the second displacing means and the second optical spectrum dispersing means creates a second intrinsic optical delay between the wavetrains of the second relatively displaced object beam and the second relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the second reading element.

83. A spectral interferometry method according to Claim 82, wherein the second displacing means produce the second relatively displaced object beam and the second relatively displaced reference beam by using one or a combination of reflection, deflection and refraction of at least one of the second object beam and the second reference beam.

84. A spectral interferometry method according to Claim 82 or 83, further comprising orienting the optical spectrum dispersing means and the second optical dispersing means in such way that in combination with their respective relatively displaced object beam and relatively displaced reference beam, the spectrally dispersed beams from the optical spectrum dispersing means and the second optical spectrum dispersing means exhibit intrinsic delays of opposite sign.

85. A spectral interferometry method according to Claim 84 when dependent on Claim 63 or any claim dependent on Claim 63, wherein the second reading element provides a signal to a second signal analyser, the method further comprising providing a profile of reflectivity versus optical path difference for the target object covering both signs of optical path difference values on the basis of signals output from the signal analyser and the second signal analyser.

86. A spectral interferometry method according to any one of Claims 82 to 85, wherein a signal output of each of the reading element and the second reading element is sent to a separate frequency to amplitude converter, the apparatus being arranged such that the output of one frequency to amplitude converter is summed to an inverted output of the other frequency to amplitude converter in order to provide a signal strength proportional to the axial position of a single layer object irrespective of the OPD sign.

87 A spectral interferometry method according to any one of Claims 82 to 86, further comprising:

using third beam splitting means arranged between the displacing means and the optical spectrum dispersing means to receive the relatively displaced object beam and

the relatively displaced reference beam and to produce a third relatively displaced object beam and a third relatively displaced reference beam;

using third displacing means to adjust the relative displacement of at least one of the third relatively displaced object beam and the third relatively displaced reference beam;

using third optical spectrum dispersing means to receive the third relatively displaced object beam and the third relatively displaced reference beam, and to disperse their spectral content onto a second reading element;

wherein in use the combination of the third displacing means and the third optical spectrum dispersing means is creates a third intrinsic optical delay between the wavetrains of the third relatively displaced object beam and the third relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the third reading element.

88 A spectral interferometry method according to Claim 87, wherein the third displacing means adjusts the relative displacement of at least one of the third relatively displaced object beam and the third relatively displaced reference beam using one or a combination of reflection, deflection and refraction of at least one of the third relatively displaced object beam and the third relatively displaced reference beam.

89 A spectral interferometry method according to any one of Claims 82 to 88, further comprising using a source that is a low coherence source the output of which is send with a delayed replica by means of an optical duplicating element.

90. A spectral interferometry method according to Claim 85, further comprising arranging the signal analyser and the second signal analyser in such a way that only two main peaks are retained in total in the accumulated signal output of the signal analyser and the second signal analyser, and determining the thickness of the object on the basis of the difference between the maximum and minimum frequency of the two peaks arising at the output of one of the signal analyser and the second signal analyser when

no other signal exceeds a threshold at the output of the other of the signal analyser and the second signal analyser.

91 A spectral interferometry method according to Claim 85, further comprising arranging the signal analyser and the second signal analyser in such a way that only two main peaks are retained in total in the accumulated signal output of the signal analyser and the second signal analyser, and determining the thickness of the object on the basis of the sum of the extreme frequencies of the signal analyser and the second signal analyser when the signal exceeds a threshold only once in the output of each of the signal analyser and the second signal analyser.

92 A spectral interferometry method according to Claim 90 or 91, further comprising using a thresh-holding circuit mounted at the output of each of the signal analyser and the second signal analyser to discard non-essential peaks which represent noise and peaks from the target object of smaller amplitudes in such a way that only two main peaks are retained in total in the accumulated signal output of the signal analyser and the second signal analyser.

93. Spectral interferometry apparatus, comprising an interferometer adapted to be excited by an optical source, the said interferometer comprising:

a first optical path leading from the interferometer to a target object;

a second optical path leading a reference light beam to displacing means;

interface optics adapted to transfer an optical beam from the optical source to the target object along the first optical path, to transfer an optical output beam from the target object back to the interferometer along the said first optical path, and to transfer said optical output beam along a third optical path to the displacing means to produce an object beam;

reference optics adapted to transfer the reference beam to the displacing means along the said second optical path;

the displacing means being adapted to reflect the object beam and the reference beam in order to relatively displace the object beam and the reference beam to produce a relatively displaced object beam and a relatively displaced reference beam, wherein

there is an optical path difference between the relatively displaced object beam and the relatively displaced reference beam generated in the interferometer;

optical spectrum dispersing means adapted to receive the two relatively displaced beams, and to disperse their spectral content onto a reading element;

wherein in use the combination of the displacing means and the optical spectrum dispersing means is arranged to create an intrinsic optical delay between the wavetrains of the two relatively displaced object beam and the relatively displaced reference beam which can be used with the optical path difference in the interferometer to generate a channelled spectrum for the optical path difference in the interferometer on the reading element; and

processing means adapted to control the optical path difference between the relatively displaced object beam and the relatively displaced reference beam in the interferometer as well as the intrinsic optical path difference between the same beams.